newsletter

Ray W. Herrick Laboratories

Purdue University, West Lafayette, IN 47907-2031

https://engineering.purdue.edu/Herrick

Fall 2010
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New Building Update

When you receive this newsletter, it'll be just over a year since we heard about the NIST grant for the building, which with the funds already raised have allowed us to proceed with Phase I of what we anticipate to be a two phase rebuilding and expansion of the Herrick Laboratories. Plans for Phase I of the Labs are on schedule, just about to enter the detailed construction drawing phase. This new building will be across the parking lot on the east side of the current building south of the "round barn" that started its life as a show pavilion, and will remain (see next page).

There have been a lot of building meetings this year, and the Architectural Engineering professors, Thanos Tzempelikos, Ming Qu, Travis Horton and Panagiota Karava have been working with the other Herrick professors on the design of the new building. Of course, our dreams exceed our budget, but we are working together to get the project within budget while making sure the building infrastructure is there to enable us to expand capabilities as we need them.

We are also working with industrial partners for in-kind gifts to make the funds stretch even further. Of course, we are still happy to receive donations and these would enable us to develop the capabilities more fully from the beginning instead of adding them later.

Phase I essentially replaces and expands the area for the thermal sciences, engines, electromechanical and vibrations and dynamics research, currently housed in the East and West Wings. It also includes the office and administrative space and the Living Lab and the Perception-based Engineering Laboratory. Details in the next column. Preliminary layout and position on campus shown below.

The Living Laboratory: these are four 24-person student offices with reconfigurable HVAC&R, Air Quality and building envelope systems. These will be used to test out new building technologies. The whole building will also be used as a testbed for building energy management strategies including geothermal. The research has an integrated focus on occupants and building (health, comfort, productivity, sustainability and energy efficiency).

Thermal Sciences and Large Scale Machine Research: HVAC&R equipment and system focused: compressors, heat exchangers, furnaces, advanced refrigeration systems, heating and cooling systems, small-scale refrigeration systems, etc. This space is a combination of specialized rooms and open flex space with plug and play utilities.

Engines, Vibrations, and Electromechanical Systems Labs include four engine test cells, flex space for vibration and electromechanical system experiments, and a smaller scale vibrations laboratory.

In the **Perception-Based Engineering Lab** temperature, humidity, air quality, acoustics, vibrations (2D), lighting will all be controllable. It will be used to develop models that predict human responses to single and combined stimuli. These models are used with *engineering* stimulus prediction models to optimize environments for the people affected by them.

Roof-Top Facilities: The Laboratory roof is being designed to accommodate future installation of solar arrays and small buildings for building façade and roof research.

In addition in Phase I there is the **Administrative & Collaborative Space:** Faculty, staff and post-doc offices and additional student offices as well as the conference rooms, the kitchen area, and space for group interactions—both academic and social.

When Phase I is completed (Fall 2012), the acoustics wing and the technical support space will comprise Phase II. As you will have read in the last newsletter, we have already starting planning the acoustics facilities. (*Continued on page 2…..*)

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Upcoming

Spring 2011

Herrick Laboratories new building ground breaking will be scheduled to coincide with start of construction. Currently anticipated to be late April or May.

Summer 2012

July 14-15, 2012:

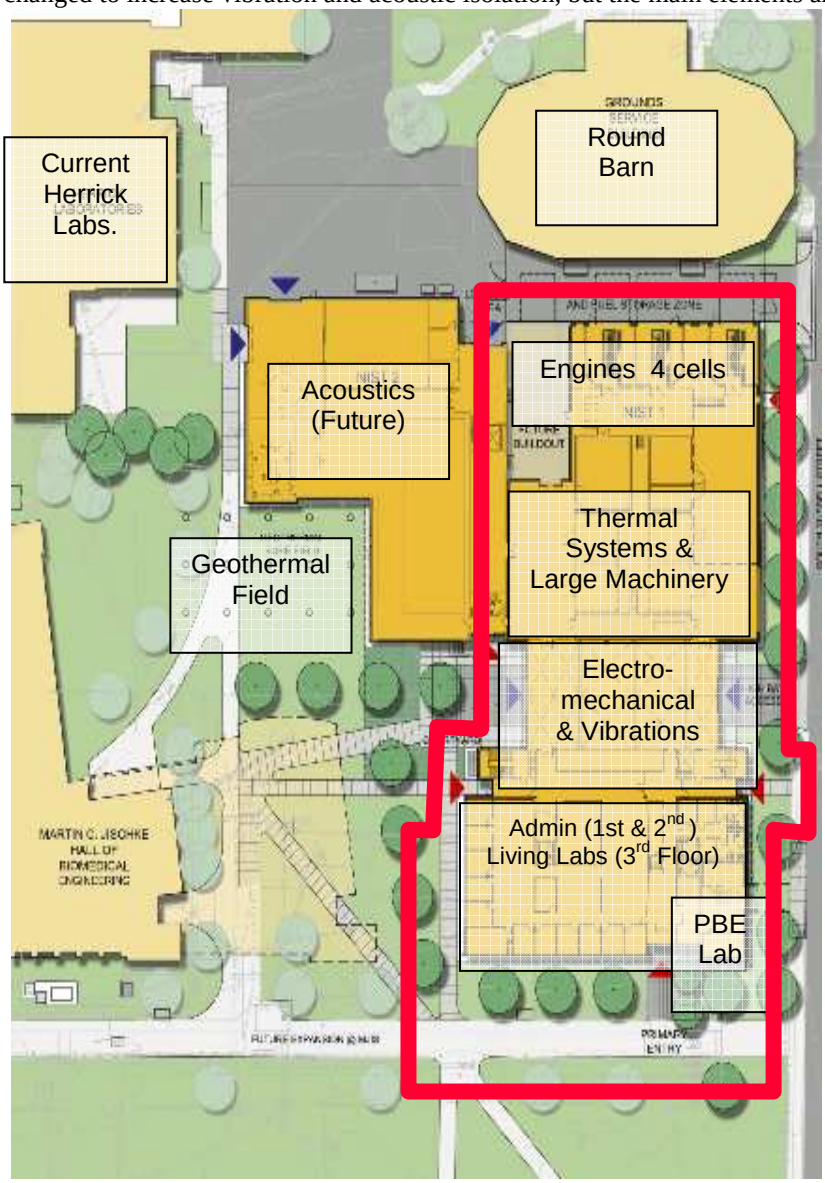
Short courses prior to the three Purdue conferences.

July 16-19, 2012:

- 21st International Compressor Engineering Conference
- 14th International Refrigeration and Air Conditioning Conference
- 2nd International High Performance Buildings Conference

New Building *continued from page 1*

The site map is to the left showing the location of Phase I (outlined below). This is one version that has since been modified to include, e.g., 4 engine test cells. For details of the acoustics laboratories, see the last Spring 2010 newsletter. The proposed layout has changed to increase vibration and acoustic isolation, but the main elements are the same.



The final part of the lab is the technical support space, currently very confined and "bursting at the seams". This will be adjacent to the Phase I & acoustics facilities. In the original space plan for the labs (put together in 2000 under the directorship of Bob Bernhard), this area includes:

Mechanical Shop for experimental rig fabrication. Supports all research at the laboratories, used by technical support staff working with graduate students.

Electrical & Electronics Shop for instrumentation repair, computer and controller configuration and upgrades, fabrication of electronic and electrical systems for experimental rigs, etc.

Rig Fabrication Space for various experimental rigs under development. Rigs can vary from very small to very large including parts of, e.g., buildings or aircraft, large and small compressor testing apparatus.

Electronic Equipment, Computer, Instrumentation and Software Repository Researchers at Herrick share equipment requiring a central repository where instrumentation is checked out and tracked.

Calibration and Equipment Learning Room houses calibration equipment for instrumentation and transducers. Having a specific space for this will help in training of new students on how to use, take care of, and calibrate instrumentation.

Storage and Staging Space to house components and materials required to build rigs, testing apparatus not currently in use, to prepare a system with instrumentation prior to installation in special-purpose chambers, to house multiple machines being tested in, e.g., a repeatability study, or a study where a modification is applied to multiple systems and tested.

Office Space for Technical Support Integrated into this technical support space will be offices for the technical support staff.

If you wish contribute to the building fund, naming opportunities and in-kind gifts, please contact Laura Edwards in the Mechanical Engineering Development Office or Patricia Davies, Director, Ray W. Herrick Laboratories. There are a number of naming opportunities available, soon to be posted on the web site.

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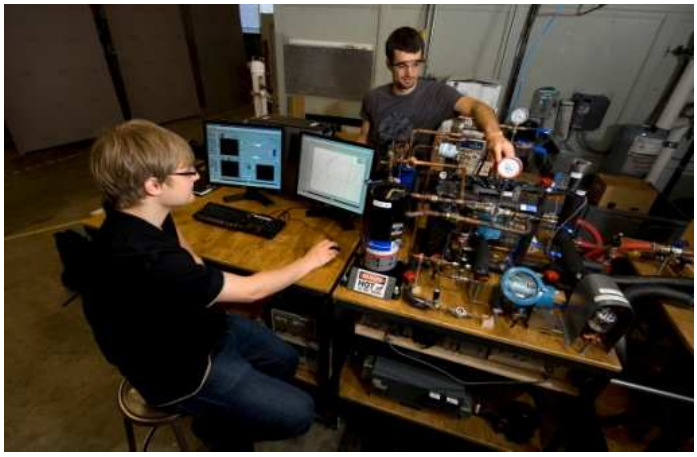
For more information on giving to Herrick Labs, see:
https://engineering.purdue.edu/Herrick/Giving/index.html

New System to Reduce Heating Costs in Cold Climates

—Emil Venere, Purdue University News Service

A new type of heat pump being developed at Purdue University could allow residents in cold climates to cut their heating bills in half. The research, funded by the U.S. Department of Energy, builds on previous work that began about five years ago at the Herrick Laboratories. Heat pumps provide heating in winter and cooling in summer but are not efficient in extremely cold climates, such as Minneapolis winters. Professors Jim Braun, Eckhard Groll and Travis Horton are working jointly on the project.



Frederick Welck, at left, an intern from the Institut für Technische Chemie in Clausthal-Zellerfeld, Germany, and mechanical engineering doctoral student Christian Bach work with an experimental setup for testing valves as part of research to develop more efficient heat pumps. (Purdue University photo/Mark Simons)

The innovation aims to improve efficiency in general, but is especially practical for boosting performance in cold climates. The new heat pumps might be half as expensive to operate as heating technologies now used in cold regions where natural gas is unavailable and residents rely on electric heaters and liquid propane.

"We'll be able to extend the geographical range where heat pumps can apply," Travis Horton said. "So this could open up a whole new market."

Researchers expect to complete a prototype by the end of the three-year, $1.3 million project. The research, which also involves three doctoral students, is a partnership with Emerson Climate Technologies Inc. and Carrier Corp. Emerson will work with researchers to create the prototype heat pump, and Carrier will integrate the new heat pump into a complete system.

Two research papers about the work were presented during the 13th International Refrigeration and Air Conditioning Conference, the 20th International Compressor Engineering Conference and the first International High Performance Buildings Conference from July 12-15 at Purdue. The papers were written by Herrick doctoral students Margaret Mathison and Ian Bell (see page 4).

The new technology works by modifying the conventional vapor-compression cycle behind standard air conditioning and refrigeration.

The standard vapor-compression cycle has four stages: refrigerant is compressed as a vapor, condenses into a liquid, expands to a mixture of liquid and vapor, and then evaporates. The project will investigate two cooling approaches during the compression process. In one approach, relatively large amounts of oil are injected into the compressor to absorb heat generated throughout the compression stage. In the second approach, a mixture of liquid and vapor refrigerant from the expansion stage is injected at various points during compression to provide cooling. The added steps improve the compression process while also reducing energy losses due to friction in the expansion stage.

"Cooling the compressor keeps the refrigerant dense, and that's important because it takes less energy to compress something that's more dense," Jim Braun said.

The researchers are developing a system for precisely controlling the flow of refrigerant from the evaporation stage into the compression stage using a series of small valves. A critical component of the new heat pump is a "scroll compressor," which uses a rotating, scroll-shaped mechanism to compress refrigerant. Domestic heat pumps normally use reciprocating compressors, in which a piston compresses refrigerant.

"You can't inject a liquid into a reciprocating compressor, whereas you can with a scroll compressor, which is uniquely suited for this modification," Eckhard Groll said. "Also, an important part of our project will be to determine the efficiency of a machine that pumps liquid while also compressing gas, so there will be a lot of computational modeling involved."

The work grew out of research into the Ericsson cycle, an exotic refrigeration technology in which liquid is added to coolant as it is being compressed. The Ericson cycle, however, does not use the vapor-compression cycle because the gas never turns to liquid.

The Purdue researchers also are working in a related project with the California Energy Commission.

Denise Goldschmidt's drawing of the Laboratories

Student Fellowships

Fontaine Fellowship

This fellowship is given to a student who is very good academically and shows leadership, someone who helps strengthen the sense of community within the laboratories. Ian Bell throughout his time at the Labs has been an exemplary student, helping in the organization of the Purdue conferences, giving tours, mentoring students in his research group, etc. Most recently he has taken the initiative to help set up a Herrick e-publications site under the Purdue Libraries that increases accessibility to Herrick researchers' publications.

Ian Bell: My research is focused on the application of liquid flooding to vapor compression refrigeration, air conditioning and heat pump systems. This work follows in the footsteps of research conducted by Jason Hugenroth, an alumnus of Herrick Labs.

The basic concept of liquid flooding is that as you compress a mixture of liquid and refrigerant vapor together, the liquid can absorb the heat of compression of the gas, resulting in a process that can approach isothermal, or constant temperature, compression. The benefits of liquid flooding can only be fully captured with the addition of a regenerator which subcools the refrigerant exiting the condenser against the refrigerant vapor exiting the evaporator.

With the addition of liquid flooding and regeneration, the benefits to system efficiency can be large.

This technology is particularly well-suited to systems operating over large temperature differences—for instance heat pumps operating in very cold climates. For this reason, the Department of Energy has awarded Herrick Laboratories and its industrial partners $1.3 million to develop low-temperature heat pumps, including liquid-flooded heat pumps.

One of the critical components of the flooded compression system is the liquid-flooded compressor, and scroll compressors are ideally suited to the task of liquid flooding due to their continuous, gentle compression process and no necessity for inlet or discharge valves. A detailed thermodynamic and geometric model of the liquid-flooded scroll compressor has been developed which very accurately predicts the performance of the compressor with liquid flooding.

For me, receiving the Fontaine fellowship has meant that I can focus my time on the liquid flooded compression technology and assist the incoming students as I finish my studies and hand over my knowledge on liquid flooding. I will finish my Ph.D. in May, and I will look back with fond memories on my time at Herrick Labs.

Lambert Fellowships

The Ward A. Lambert Graduate Teaching Fellowship in Mechanical Engineering was established in memory of Ward Lambert who was a legendary Purdue baseball and basketball coach. The fellowship is funded by gifts solicited from the School of Mechanical Engineering (ME) alumni, and is for ME doctoral graduate students who have the potential and desire to pursue an academic career. The fellows are paired with master teachers from the School of Mechanical Engineering who serve as mentors during the one-year fellowship period.

Since the introduction of the Lambert Teaching Fellowship in the fall of 2009, two Herrick students have received the award. Margaret Mathison was one of three ME students awarded the fellowship in the fall of 2009, and served as an instructor for ME 200, Thermodynamics I, for the spring 2010 semester. Tyler Dare was awarded the fellowship in the summer of 2010, and is currently an instructor for ME 270, Basic Mechanics I.

Margaret Mathison: I received my undergraduate degree from Iowa State University in my hometown of Ames, Iowa. I chose to pursue a Ph.D. because of my interest in teaching, and selected Purdue for graduate school on the recommendation of several of my undergraduate professors who were Herrick Lab alums. At Purdue I have been fortunate to work with Professors Jim Braun and Eckhard Groll in the thermal systems research area. My research began with the development of a comprehensive two-stage rolling piston compressor model which demonstrated the energy savings that can be achieved by cooling the refrigerant between compressor stages. However, economized refrigerant can also be injected during the compression process of a single stage compressor to achieve performance improvements without the cost of a multi-stage compressor. Increasing the number of refrigerant injection ports improves the vapor compression cycle performance, and I have developed a cycle model to predict the limit to cycle performance with continuous refrigerant injection. However, the cycle model uses several simplifying assumptions, and thus my current research aims to more accurately predict the effect of refrigerant injection through modeling and testing of a novel prototype compressor.

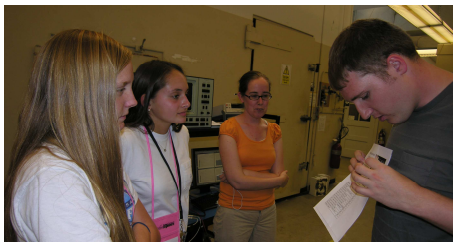
In addition to my research, I have served as a teaching assistant for thermodynamics and heat transfer courses. However, the Lambert fellowship provided a unique opportunity to develop my own classroom materials and teaching style under the guidance of experienced professors. Whereas many new faculty members must work through the challenges of teaching for the first time while also establishing a new research program and acclimating to a new institution, I had a support network to make the experience positive. During my "apprenticeship", I attended classes taught by my mentor, Professor Robert Lucht, and observed how he handled difficult concepts and classroom situations. As I was teaching I received valuable advice from my research advisors and Professor Davies, who shared her office in the ME building with me for my office hours. While I realize that there is always room for improvement as a teacher, I feel confident that this experience will serve me well in the future and ease the transition into the role of a faculty member.

Continued on next page…

Tyler Dare: I graduated from the University of Illinois in Urbana-Champaign with a degree in Engineering Mechanics in 2006. I had been interested in acoustical engineering for several years, and I chose Purdue for graduate school because of the reputation of Herrick Labs' acoustics program. My research involves several different aspects of tire-pavement noise. With my advisor, Professor Bernhard, I am focused on determining the causes of tire-pavement noise and how new pavements can be developed to reduce noise generation. I also work with researchers at the North Central Superpave Center to develop noise-reducing asphalt pavement. Through our work, we have developed some of the quietest asphalt and concrete roadways, including the quietest concrete pavement in North America.

The Tire-Pavement Test Apparatus on which Tyler does his experimental research, located in the semi-anechoic chamber at Herrick.

The Lambert Teaching Fellowship has been my first exposure to teaching at Purdue, and so far it has been my most enjoyable position in graduate school. During the summer semester, I worked with and observed my mentor, Professor Jim Jones. With the assistance of Professor Jones and training seminars through the Center for Instructional Excellence at Purdue, I developed teaching techniques that have helped my students learn more during lecture. In the classroom, I employ active learning methods, in which the focus is on student engagement and instant feedback. Though this semester has been my busiest in my four years at Purdue, the Lambert fellowship has been invaluable to me as a teacher and has given me a good experience that will make the first few semesters in a new faculty position much more manageable.



Tyler last year with fellow acoustics student Sarah McGuire, working with high school students as part of the Women in Engineering EDGE summer program.

For upcoming summer WIEP 2011 programs, see:
https://engineering.purdue.edu/WIEP/Programs/K-12/EDGE

Historical Notes…

Recently I (Patricia Davies) was looking through the drawers of photographs looking for the photos that Ray Cohen used to have under the glass on the big table in his office. The Institute of Noise Control Engineering is celebrating its 40th birthday this year at the Portland Noise-Con 2011 meeting at the end of July and I recalled that there were some photos that Ray had of Bill Lang, George Maling, Leo Beranek and others who had started the organization. In the drawers there were the stacks of photos from many events at the laboratories: IACs, summer picnics, holiday parties, retirements, etc. Here are just four pictures.

Two are from a picnic at Fort Quiatenon in May 1989 where postdoc Henry Hall (head cook, center), acoustics grad students Doug Mandic (left, also a great cook) and Don Ufford (right, see page 10) organized a hog roast. After setting the fire at around 4 in the morning, it started to snow, and by noon, while it had stopped snowing, the wind was blowing and it was freezing—yes this was mid-May in Indiana.

May 1989 picnic: on the left Yoshimi Takeuchi and Peter Konieczny, on the right Tom Wahl.

We took turns draping ourselves over the pig roaster, in contact with the metal and not getting burnt, an indication of how cold it was. The pork took ages to cook despite the insulation provided by desperate people trying to get warm.

We recently held our annual Holiday Party at the Labs. Fritz Peacock (head of technical services) cooked a turkey and people brought in side dishes. Fritz will be retiring in the new year (2011), but will still be around for a while helping out with the new building and the engines research.

Here are two more pictures from holiday parties in the early and mid 1980s. Stuart Bolton, just after he came to Herrick in 1984, leaning on the door jamb to the old conference room listening to the musicians with Pat Brandyberry, the financial clerk at Herrick for many years.

The Holiday Season brings us both joy and sadness, it is a time for reflection and a time to enjoy (or survive) the visits from and to the relatives and friends, and for many of us all that snow shoveling, too. I wish you all the very best for the coming year.

Industrial Advisory Committee Meets

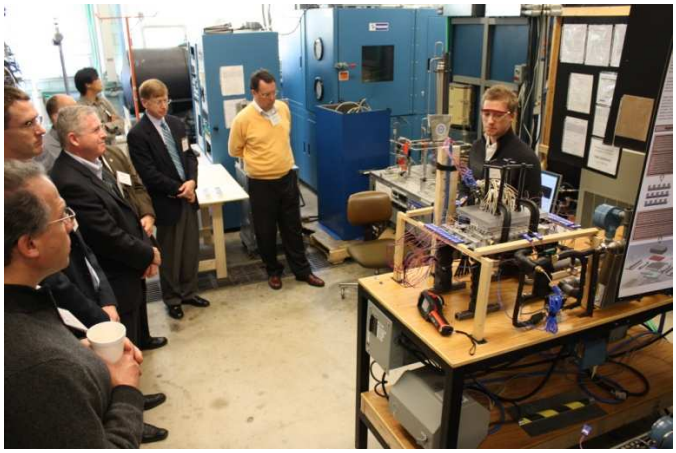
The Industrial Advisory Committee met on Thursday, November 4 through November 6. The meeting began at 3:00 at the Purdue Center for System Integrity (PCSI) located in the Kepner Building in Lafayette. After the introductions and welcome by committee chair, Terry Manon, and Herrick Laboratories director, Patricia Davies, the meeting began with updates on some of the recent larger scale research proposals. Doug Adams also updated the group on changes at the Kepner Building and new activities at the PCSI. Research presentations were made on Sound and Electromagnetic Interacting Waves, Energy Efficiency Hub, Heat Pumps for Northern Climates, Wood to Wheels, and a Super Truck project. After the presentations, the IAC members, the students at PCSI hosted a poster show with demonstrations of some of the experimental research techniques being developed.

Friday morning began with an overview of the day by Terry Manon. Then Anil Bajaj, interim head of the School of Mechanical Engineering, welcomed the group and gave a report on activities within Mechanical Engineering. Patricia Davies presented a summary of the last year's activities at the Laboratories. The morning ended with the poster show hosted by the students at HERL on the main campus. This also included demonstrations of the experimental components of their research.

Friday afternoon was a discussion of the new building with an overview of the plans. The committee was able to get a detailed look at Phase I components (see pages 1 and 2).

Friday ended with a relaxing dinner at Jane's, and Saturday morning a brunch was held at the home of Patricia Davies and J. Stuart Bolton. Then it was off to the game.

Here are some of the highlights of the Friday morning poster show at HERL.



Bryce Shaffer explains his research in conduction cooled electronic/electrical modules in liquid cooled cabinets for aircraft application. As the consumer demand for more in-flight capabilities increases the demand for more robust onboard electronics/electrical cabinets on aircraft also increases. The heat loads increase making the use of conventional convection air cooling less practical and increases the risk of the cooling system interfering with public cabin temperatures at high heat loads. A redesign is being considered using a microchannel arrangement in place of cylindrical channels. If results from models are achieved in the experimental analysis; then the sponsor's current heat transfer ratio used for higher dissipating systems will be achieved while meeting thermal requirements.
(Photo by Michael Black)

Margaret Mathison explains performance limit for economized cycles with continuous refrigerant injection. Modifying the basic vapor compression cycle to use multi-stage compression introduces the possibility of conditioning the gas between compressor stages by economization. A need exists for a comprehensive compressor model that can predict the effects of refrigerant injection on the compressor performance. (Photo by Andrew Jessop)

Karla Stricker explains the promotion and control of advanced mode diesel combustion with variable valve actuation. Other students working on the research project are Lyle Kocher, Ed Koeberlein and Dan VanAlstine. Advanced combustion strategies including premixed charge compression ignition and lifted flame combustion can help achieve reduced emissions levels while maintaining or improving fuel efficiency. A control system has been developed and implemented in dSPACE to dictate the required intake valve profiles and control the tracking of the valves on the engine with a variable valve actuation system. (Photo by Michael Black)

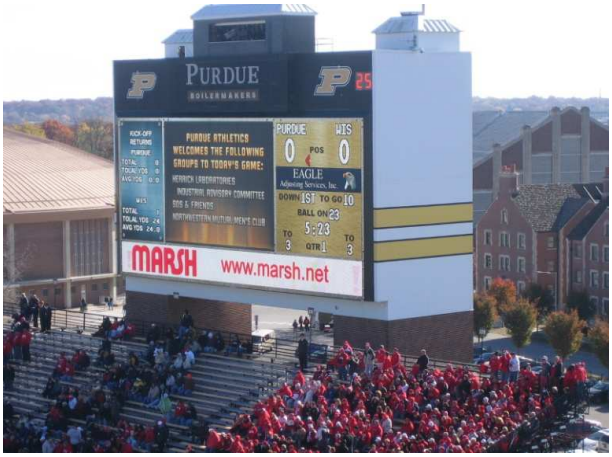
Industrial Advisory Committee Meets

Andrew Marshall explains sound quality of aircraft noise and its impact on annoyance. Manufacturers of business jets have proposed the creation of supersonic jets that result in shaped sonic booms (called "low" booms) which would likely have less impact on communities than booms from the previous generation of supersonic aircraft. The results of the research will help determine how responses to the shaped sonic booms differ from those arising from "normal booms". Improved methods of assessing the impact of the impulsive sounds that people may hear are another outcome of the research. While this research is focused on sonic booms, the research results should also be applicable to other situations where people are exposed to impulsive sounds such as gunfire, explosions, and large machinery start-ups and shutdowns.
(Photo by Michael Black)

David Yuill presents his research to Bill Glover, Todd Rossi, Terry Manon, Marcus Bianchi, and James Botic. David's research is on Development of Methods for Evaluating Diagnostics Systems in Air Conditioning Equipment. Many protocols for fault detection and diagnostics (FDD) in packaged air conditioning equipment have been developed recently and are being marketed. A project with the New Building Institute will develop a method to evaluate protocols and to determine the impact of their operation on efficiency.
(Photo by Andrew Jessop)

Ned Troxel, one of Prof. Bin Yao's students, demonstrating the electro-hydraulic arm apparatus that he uses to test the approaches that he develops for control of these types of time-varying, nonlinear systems.
(Photo by Andrew Jessop)

Yangfan Liu, Prof Stuart Bolton's student, demonstrating experimental array techniques for characterization of complex acoustical sources. The methodology is being used to develop acoustical models that accurately predict directivity patterns of acoustic sources in audio-visual equipment.
(Photo by Andrew Jessop)



There was an official recognition of the group on the big screen at the stadium. Unfortunately Purdue lost to Wisconsin 34 to 13.

Short Courses and Conferences Held at Purdue

The 20th International Compressor Engineering Conference, the 13th International Refrigeration and Air Conditioning Conference, and the 1st International High Performance Buildings Conference took place July 12th to the 15th, 2010 on the campus of Purdue University in West Lafayette, Indiana. The Compressor Engineering Conference included many sessions on specific compressor technologies, such as reciprocating, rolling piston, scroll, screw, centrifugal, linear and novel compressors, and issues related to compressor design and reliability, such as noise control, vibrations, gas pulsations, lubrication, wear, and valves.

In addition, there were several sessions that focused on new and existing applications of compressor technologies. The Refrigeration and Air Conditioning Conference covered a wide range of topics, including transcritical carbon-dioxide and other novel refrigeration cycles, heat transfer/exchanger issues, system modeling (steady-state and transient), heat pumps, and specific applications in industrial refrigeration, supermarket refrigeration, and automotive air conditioning.

The High Performance Buildings Conference covered many areas of building design and performance, including building thermal systems, solar energy use in buildings, sustainable buildings and green technologies, building envelopes and facades, net-zero building design, indoor environment and human comfort, acoustics, building simulation, and integrated building design. In addition, there were tours of the Herrick Laboratories as well as the innovative Purdue "green roof" experiment. Many new Purdue departments took part in the conferences as well as members of the 2011 Purdue Solar Decathlon Team.

James E. Rogers during the keynote address.

Several distinguished people were speakers. The keynote speaker was James E. Rogers, Chairman and President of Duke Energy Corporation, USA. He spoke on "Repowering Our Economy by Balancing the Need to Deliver Affordable, Reliable and Clean Energy". There were several plenary speakers. Dr. Noriaki Ishii from Osaka Electro-Communication University in Japan spoke on "The Significance of Fundamental Academic Research in the Development of Super-Performance Compressors and Beyond". Denise Coogan, from Subaru of Indiana Automotive, Inc., USA addressed the group on "Greening Your Business". On Wednesday, Oliver Finckh with Carrier Kältetechnik Deutschland GmbH, Germany spoke about "Development of Carbon Dioxide Commercial Refrigeration Systems in Europe", and the last plenary speaker was Andreas Athienitis from Concordia University in Canada whose topic was "Modeling, Design and Control of Solar and Zero-Energy Buildings in Canada"

Three Distinguished Service Awards were given to Joost Brasz (Danfoss Turbocor Compressors, Inc.), Jack Elson (Emerson Climate Technologies, Inc.) and Bruce Hunn (ASHRAE) for their years of service to the Conferences in various capacities. The Lifetime Achievement Award was given to Jean-Luc Caillat (Emerson Climate Technologies, Inc.). This award is not given out at every conference since it recognizes significant contributions by an individual over his or her entire career. In addition, Clark Bullard of the University of Illinois in Urbana-Champaign received the Wilbur T. Pentzer Achievement and Leadership Award for outstanding contributions to the growth and well-being of the International Institute of Refrigeration (IIR) and the U.S. National Committee of the IIR.

Other awards this year included a student paper award competition sponsored by Tecumseh Products, Inc. It was held for the first time for all three conferences. The selection committee was made up of professors from all fields as well as Advisory Committee members. Three current Herrick graduate students received awards for their papers: Ian Bell, Craig Bradshaw and Margaret Mathison.

Approximately 600 people attended the conferences representing 32 different countries. The final program, keynote talk, plenary talks and the technical papers are on the CD ROM proceedings or in the printed proceedings and are available at *http://www.ecn.purdue.edu/Herrick/Events/*.

Dates for the next conference are July 16th to the 19th 2012. As in the past, short courses will precede the conference and they will be held on July 14th to the 15th, 2012.

Former Conference Secretary Visits

Ginny Freeman (left), the current Program Secretariat for the Herrick short courses and conferences, and Persus Newman (right) share a common interest in historical preservation.

Persus Newman worked at Herrick Labs from 1972 to 1974. She worked on some early Herrick conferences with people like Victor Goldschmidt, Jim Hamilton, Werner Soedel, and Ray Cohen. She also worked on the *Noise Control Engineering Journal* with Victor Goldschmidt, Barbara Pattarozi and Malcolm Crocker. Persus and her husband, Jim, live in Westminster Village in West Lafayette, and both are still active in many community organizations.

National Academies Report

Bob Bernhard and **Patricia Davies** worked on a National Academy of Engineering committee focused on Technology for a Quieter America. The report from the 10 person committee is now published. More information can be found at *http://www.nap.edu/catalog.php?record_id=12928.* Below is the preface written by George Maling, the committee chair. **Stuart Bolton** also contributed to this project.

"Noise emissions are an issue in industry, in communities, in buildings, and during leisure activities. As such, the audience for a report on noise control is broad and includes the engineering community; the public; government at the federal, state, and local levels; private industry; labor unions; and nonprofit organizations. These stakeholders should find something of interest in this report.

In the past few decades advances have been made in noise control technology, instruments for noise measurement, and criteria for noise control. These advances need to be recognized in our approach to the control of noise and public policy designed to improve the noise climate in the United States. This, together with increasing worldwide interest in reducing noise, makes it necessary to examine American interests in the production of low-noise products with a view toward remaining competitive. Reducing product noise emissions and achieving noise reductions in our factories, office buildings, classrooms, homes, and the environment are challenging problems.

The study was undertaken by the National Academy of Engineering (NAE) to emphasize the importance of engineering to the quality of life in America, in particular the role of noise control technology making possible a quieter environment. This report was prepared by a study committee and five supporting panels of experts appointed by the NAE and reviewed by an independent panel appointed following NAE procedures. Implementation of the recommendations in the report will result in reduction of the noise levels to which Americans are exposed and will improve the ability of American industry to compete in world markets where increasing attention is being paid to the noise emissions of products.

Key areas where recommendations have been made include cost-benefit analysis of noise reduction, especially related to road traffic noise; improved metrics for noise control; lower limits for noise exposures in industry; 'buy quiet' programs; wider use of international standards for noise emissions; airplane noise reduction technology' and noise control in structures such as schools, hospitals, and office buildings. Also recommended is improved cooperation between industry and government agencies involved with noise and, in particular, an expanded role for the Environmental Protection Agency, which can be undertaken under existing law."

George C. Maling, Jr., Chair
Committee on Technology for a Quieter America

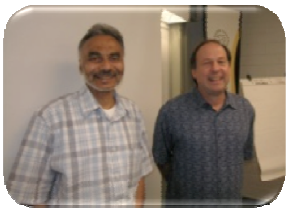
Interim Head of the School of Mechanical Engineering Appointed

After working with the School of Mechanical Engineering for 11 years, E. Dan Hirleman accepted the position of Dean of the School of Engineering at the University of California Merced. His last day at Purdue was August 18. We wish him the very best in his new endeavor.

In the interim, his position is being filled by Anil K. Bajaj who is the Alpha P. Jamison Professor of Mechanical Engineering. Some of you may know Professor Bajaj began his faculty career as an Assistant Professor in Mechanical Engineering in 1981, shortly after receiving his Ph.D. from the University of Minnesota. He most recently served as the Associate Head for Graduate Research and Education in Mechanical Engineering, a position he has held since March 2001. Anil has been working for many years with Patricia Davies at the Herrick Laboratories on modeling of polyurethane foam and seat-occupant systems and nonlinear structures.

Anil's appointment was effective August 16, 2010. A search committee was formed to conduct a national/international search for the next head of Mechanical Engineering.

Former Faculty Member Visits



Satish Ramadhyani (left) and Jim Braun (right)

Satish Ramadhyani, a former Purdue ME heat transfer professor, visited in August. He left Mechanical Engineering in 1998. He is now Lead Systems Engineer with Galil Medical, Inc. in Minneapolis office. The headquarters for Galil Medical is in Israel. He returned to campus on August 12, 2010 and gave a seminar in at Herrick Labs. entitled, "Design of a Joule-Thomson Cryoablation System for the Treatment of Organ Cancers." During his visit, he discussed some research ideas related to cryogenics with Jim Braun and Eckhard Groll.

Why So Few? AAUW Talk in Valparaiso

Patricia Davies (pictured with Lila Cohen) gave a talk to the Valparaiso Chapter of the American Association of University Women on November 3rd. The talk was centered on the question of why there are so few women in Science, Technology, Engineering and Mathematics (so-called STEM disciplines). While numbers have improved over the last 20 years at the graduate and faculty levels, there is still a long way to go. The presentation on the AAUW website was the foundation material for the talk which turned into a lovely discussion between Patricia and the audience. For more information on the issues, see: *http://www.aauw.org/learn/research/whysofew.cfm.*

Don Ufford Named OME

Reprinted with permission from ME OME website

Don Ufford (MSME 1989) was named a 2010 Outstanding Mechanical Engineer. He is the Chief Engineer of Vehicle Engineering for Ford Motor Company in Dearborn, MI. In this capacity, he and his team have the responsibility of delivering the customer attributes that define each Ford vehicle engineered or sold in North America. This effort has contributed to Ford's increasing market share 22 of the last 23 months, winning Car and Truck of the Year in 2010 and delivering the best quality of any non-luxury brand in the 2010 JD Power IQS survey. Prior to that, he was the Chief Engineer of vehicle engineering for Ford Trucks, where his responsibilities included the Ford F-150, which won Truck of the Year two times during his tenure. Earlier in his career, he was the Vehicle Engineering Manager for the Ford Escape, Ford's first small sport utility vehicle that sold over one million vehicles and was the basis for Ford's first hybrid. He also worked in Technology Strategy, Advanced Body Systems Analysis and Advanced Vehicle Development at Ford. He began his career at Ford in the noise and vibration department, where he introduced the results of his Purdue master's thesis in digital signal processing of incoherent sources to solving automotive problems.

Don is also active with the Boy Scouts of America, where he served as a scoutmaster, district chairman and currently as a member of the executive board of the Great Lakes council. He is also a member of the South Dakota State University Engineering Dean's Advisory Council and our Industrial Advisory Committee. He is blessed with his wife, Rebecca (in the photograph above at the OME lunch with Don), and two active children who love cars and trucks.

Don commented, "As engineers, we have the opportunity and responsibility to deal with complex issues using science and technology to develop the best solution. Often times the issues we are asked to consider have not only technical challenges but business and social implications as well. If we are correct in our assumptions, efficient in our solutions and effective in our communication, engineers will continue to be highly sought after and well regarded as leaders in business and our communities. Purdue recognizes this and has a tradition of developing leaders at all levels. I have clearly benefited from that tradition and look back with sincere appreciation for the time and effort my professors and the staff at Herrick Laboratories put into helping me develop as an engineer and leader."

Alums Return

The Short Courses and Compressor Conference bring Herrick alums back to say hello, and this year was no exception. **Stefan Bertsch** (MSME 2005, Ph.D. 2008) is a professor at his home institution in Switzerland. His major professor retired, and Stefan accepted the position. He mentioned that he is engaged and planning to marry in the next couple of months. His fiancé has her doctorate in electrical engineering. Another alum we saw was **Jason Hugenroth** (Ph.D. 2006). Jason has his own consulting business, InvenTherm, in Baton Rouge, LA. He and his wife have three children.

Keith Williams (Ph.D. 2001) and his wife, Mary Beth stopped by the laboratories on July 29. They brought their daughter, Allison (age 6); and son, Johnny (age 4) with them. They have one more son, Alex (age 9). Keith is an Associate Professor at the University of Alabama at Tuscaloosa. He's been with the university since 2001. He says "Hi, to everyone!"

Where Are They Now?

Chaitanya Bhat (MSME 2010) joined Honeywell Technology Solutions Lab as a Senior Engineer in October. He's working in the vibro-acoustics team of the turbocharger group. The team is currently involved in analyzing the structural and flow related noise generated by an automotive turbocharger. Currently, he is based in Bangalore, India. In January, 2011, he'll be traveling to France to work closely with the vibro-acoustics team there for about 3 months.

Li-Jen Chen (Ph.D. 2009) accepted an offer from Pratt and Whitney in Canada to be a Senior Analyst in the Acoustics Department.

Phanindra Garimella (MSME 2002, Ph.D. 2005) is working in Technical Specifications Systems and Controls at Cummins in Columbus, IN. He's been with Cummins since December 2005 and regularly visits Herrick to interact with the engines research group.

Yoon-ki Kim (MSME 1995, Ph.D. 2000) until recently has been Deputy General Manager of the Electronics Business Team at Hyundai Mobis in Korea. September 1st, 2010, he joined Mirae Asset as an automotive industry analyst. Mirae Asset is one of Asia's leading independent financial services company and is a major investor in emerging markets.

Robin Kusmanto (MSME 2009) is working in Alpharetta, GA as a Hardware Design Engineer in the Detailed Design and Supply Center, I&C Engineering, AREVA NP, Inc. He was in Virginia for awhile and has now moved farther south to Georgia.

Douglas Memering (MSME 1999) is working for Cummins in Columbus, Indiana as Chief Engineer in fuel systems. He's been employed by Cummins for 27 years. He also owns Powerhouse Brewing Company, a local microbrewery in the Columbus area. He's owned it for 4.5 years.

Shankar Sundararaman (MSME 2003, Ph.D. 2007) visited the Labs early in June. He is currently working for Exxon in TX.

This summer, **Peishuh-F. "Percy" Wang** (Ph.D. 1995) started a new job with Trane Air Conditioning in Tyler, TX.

Herrick Laboratories News

Faculty Honors

The last newsletter had an article about **Doug Adams'** appointment as the Kenninger Professor of Renewable Energy and Power Systems. His investiture was held in the East faculty Lounge of the Purdue Memorial Union on November 11 at 4:00. The Kenninger family was present for this special event along with Doug Adams' family.

George Chiu is now chair of the Systems, Measurement, and Control Group in the School of Mechanical Engineering. George also received the 2010 IEEE Transactions on Control Systems Technology Outstanding Paper Award. The paper citation is: C.-L. Chen and G.T.-C. Chiu, "Closed Loop Banding Artifact Reduction for a Class of Color Electrophotographic Printers with Underactuated Motor/Gear Configuration", IEEE Transactions on Control Systems Technology, Vol. 16, No. 4, pp. 577-588, July 2008.

Patricia Davies just completed her two-year term as the President of the Institute of Noise Control Engineering. The new president is Jim Thompson, a Herrick Laboratories alumnus and former IAC member *(http://www.inceusa.org/).*

Eckhard Groll is an ASHRAE Fellow and was installed as an ASHRAE Director-at-Large at the 2010 Annual Meeting held in Albuquerque, NM. He will serve a three-year term from 2010-2013. (*http://www.ashrae.com*)

Monika Ivantysynova was awarded the 2009 Joseph Bramah Medal. This medal is awarded by the Institution of Mechanical Engineers' Mechatronics Informatics and Control Group. The medal was awarded to Monika for outstanding commitment to international fluid power research and education, particularly in the field of hydrostatic pumps and motors. The Joseph Bramah fund was established in 1968 at the instigation of Frank Towler to commemorate Joseph Bramah, the inventor of a patent lock, the hydraulic press and other inventions concerned with pumps, water supply and the production of pipes and tubes by the extrusion process.

Student Honors

Carrie Hall was selected as a recipient of a Chateaubriand Fellowship given by the French Embassy. She will be studying in Paris, France for 4 months beginning in January 2011. She'll be taking a course at The École Nationale Supérieure des Mines de Paris and doing research at the Institut Français du Pétrole on combustion control of a fuel flexible gasoline engine. The goal of the project will be to provide knock control using feedforward model-based control.

Graduations

Hsin-Chien Shih (MSME May 2010), Modeling and Control of an Electro-Hydraulic Arm. Hsin-Chien's employment information is not known.

Shreekant Gayaka (Ph.D. August 2010), An Adaptive Robust Approach to Actuator Fault-Tolerant Control in Presence of Uncertainties and Input Constraints. Shreekant accepted a position with Western Digital in San Jose, CA.

Carson Budde (MSME August 2010), Impact Force Identification for Composite Helicopter Blades Using Minimal Sensing. The day of his thesis deposit, he accepted a position at Aerospace Corporation in Los Angeles, CA in their Structural Dynamics Department. Carson commented, "I will not miss the snow and cold, but if I get nostalgic I can always drive 2 hours up into the mountains!"

Dave Snyder (Ph.D. August 2010), Soy-Based Biodiesel Blend Estimation and Accommodation in a Modern Diesel Engine. Dave is employed by Cummins Inc., Columbus, IN.

Matias Zañartu (Ph.D. August 2010), Acoustic Coupling in Phonation and Its Effect on Inverse Filtering of Oral Airflow and Neck Surface Acceleration. Matias is continuing his studies as a Post-Doc working with Stuart Bolton.

Nathanael Yoder (Ph.D. August 2010), The Robust Detection of Cracks in Complex Aerospace Structures Using Nonlinear Vibro-Acoustic Modulation. Nate is employed by ATA Engineering in San Diego, CA.

Amit Mohanty (Ph.D. August 2010), Some Generalizations to the Theory of Adaptive Robust Control and Its Application with Inertial Measurements. Amit is employed by Idaho National Labs located in Idaho Falls, ID.

Shashikant (Shashi) More (Ph.D. December 2010), Aircraft Noise Characteristics and Metrics. Shashi accepted a position with Cummins Power Generation in Fridley, MN.

Derek Hengeveld (December 2010) Development of a System Design Methodology for Robust Thermal Control Subsystems to Support Responsive Space. Derek is working at the Air Force Research Laboratory located at Kirtland Air Force base in Albuquerque, NM.

Weddings and Births

Sagnik Mazumdar (Ph.D. 2009) and Debaleena Majumder were married on June 27, 2010 at the Jaymangal Hall in Kolkata, India. After the wedding the couple plans to move to their new apartment in New Jersey.

Dave Snyder (Ph.D. 2010) and Christa Quimby were married in Carmel, IN on October 2, 2010.

Garrett Thorne, Research Engineer at PCSI, and his wife Christine are the proud parents of a baby girl, Jillian Louise, born on October 24, 2010.

David Yuill (current Ph.D. student) and his wife, Lily Wang, welcomed Florence Annabeth Yuill to the family on May 30. She weighed 7 pounds 4 ounces. She has an older sister, Violet.

Oops!

Ray Cohen called about an error in our last newsletter. Terry Manon did his graduate work with Wolfgang Leidenfrost, not Bill Leidenfrost as stated.

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News about You and Address Changes

We are always interested in hearing your news, and we want to be kept up-to-date on current addresses. Please send notes to Judy Hanks or to the e-mail address below. Don't hesitate to let us know of other alums that have moved. Photos are always welcome.

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